

SUCCESS STORY

SPOTLIGHT ON: KELLY AFB - OCTOBER 1998



PRO-ACT

A Base-level Pollution Prevention Resource sponsored by HQ Air Force Center for Environmental Excellence



Introduction

The United States Air Force recognizes the importance of pollution prevention (P2) in protecting the environment, achieving compliance objectives, and reducing waste disposal costs. Successful P2 programs, including recycling, waste minimization, product substitution, and process changes, among other strategies, are planned or underway at Air Force installations worldwide. The Air Force's environmental programs must do more today than ever before, and do it with increased cost-effectiveness.

The Air Force is a leader in fostering environmental awareness and education within its workforce and communities, thereby extending environmental stewardship from a management concept to an individual responsibility. In response to executive orders, regulations, and policies, successful P2 strategies and technologies are continuously being developed, applied, and improved at Air Force bases around the world. As new ways emerge to eliminate compliance burdens, save money, and minimize chemical exposures, the Air Force is committed to collecting these P2 success stories and making them available to Air Force activities everywhere.

Background on Kelly AFB

Established in 1916, Kelly Air Force Base, the oldest continuously operated base in the Air Force, is named in honor of Lieutenant George E. M. Kelly, the first American pilot to die while piloting a military aircraft. Until its placement on the Base Realignment and Closure (BRAC) list, Kelly AFB was home to the San Antonio Air Logistics Center (SA-ALC). It is located approximately six miles southwest of downtown San Antonio, Texas, encompasses over 4600 acres, and includes over 600 buildings accounting for approximately 16 million square feet of building space. As one of five Air Force "depot" level bases, Kelly AFB was primarily responsible for providing worldwide air

Kelly AFB Success Stories

The Pollution Prevention Team	2
A. VOC Reduction Initiatives	2
B. ODS Elimination Program	2
C. EPA 17 Reduction Program	2
D. Material Substitution Program	3
E. Hazardous Waste Management	3
F. Solid Waste Management	3
Powder Paint Coating Facility	4
Chrome Plating Line Renovation	5
Innovative Water Conservation and Reuse Strategies	5
A. Water Supply and Use	5
B. Water Conservation and Reuse	6

logistics support. Kelly AFB had responsibility for over 6,000 aircraft, which included more than 33 separate aircraft systems. These aircraft included the C-5, T-38, F-5 and C-17. Kelly AFB also had responsibility for the maintenance and repair of over 75% of all Air Force aircraft engines. Currently, Kelly AFB operations are gradually transitioning to other ALCs and contractor operated functions.

The pollution prevention success stories highlighted in this report represent the successes made by Kelly AFB personnel over the past several years during a period of active maintenance and repair activities. The successes achieved by the Kelly AFB team were truly outstanding. By documenting these successes, the Air Force preserves and shares these good ideas and makes them available to pollution prevention program managers throughout the Air Force.

Kelly AFB

P2 Success Stories

The Pollution Prevention Team

The focus of the Kelly AFB Pollution Prevention (P2) Division is to control the use of hazardous materials and to incorporate pollution prevention and waste minimization measures as a standard way of doing business. The P2 Division has primary responsibility for Kelly AFB's Hazardous Materials Pharmacy or HAZMART. While pollution prevention has always been an integral part of the Kelly AFB Environmental Management (EM) Directorate, an enhanced emphasis on pollution prevention began with the creation of the Pollution Prevention Team in January 1992. The P2 Team focused on eliminating the generation of both hazardous and non-hazardous waste through material substitution and process change, with a secondary focus on reuse, recycling, and treatment. The P2 Team successfully achieved significant reductions in the use of ozone depleting substances and other hazardous materials, emission of air and water pollutants, as well as the generation of solid and hazardous wastes. In 1994, the P2 Team was the recipient of a Department of Defense Pollution Prevention award. The Environmental Management Director, Mr. Larry Bailey, and the P2 Division Chief, Mr. Robert Chabot, traveled to Washington D.C. for presentation and receipt of the award. Through the efforts of Kelly AFB's P2 Team, the base has met, ahead of schedule, the hazardous chemical reduction goals mandated by Executive Order 12856.

A. VOC Reduction Initiatives - Kelly AFB, an attainment area under the Clean Air Act, has worked closely with the Texas Natural Resource Conservation Commission (TNRCC) and the U.S. Environmental Protection Agency (EPA) to ensure that air pollution produced from the base's many industrial processes do not exceed regulatory requirements and do not adversely impact the region's air quality. Aggressively pursuing reductions of volatile organic compound (VOC) emissions through the use of control equipment and alternative processes, Kelly AFB decreased VOC emissions from 1135 tons in 1990 to 336 tons in 1994, a 70% reduction. This was accomplished in two key areas:

I. The use of perchloroethylene (PCE) in vapor degreasing operations has continued a downward trend as alternative cleaning processes are implemented and more efficient vapor degreasing units

are acquired. These changes have resulted in an 80-ton reduction of PCE emissions from a CY93 baseline.

II. Aircraft fueling operations have historically been a significant source of "fugitive" air emissions at Kelly AFB. In 1994, a switch from JP-4 to JP-8 jet fuel resulted in a 40-ton reduction of fugitive vapors from aircraft fueling operations. Further reductions achieved during 1995 allowed Kelly Air Force Base to cut fugitive VOC/hazardous air pollutant (HAP) emissions 50% from the 1993 baseline of 368 tons, thereby meeting the 1999 target date imposed by EO 12856 four years ahead of schedule.

B. Ozone Depleting Substance (ODS) Elimination Program - Seven months before the first Air Force-wide ODS elimination policy became effective, Kelly AFB voluntarily developed and implemented their own ODS elimination policy by restricting the use of any ODS that did not have both a waiver allowing the use of the material and a timetable for phasing out its use. This policy continues to be more strict than the Air Force ODS Waiver Policy. Process assessments were performed by the P2 Team to identify ODS elimination, substitution, and recycling projects. Kelly AFB, which manages all aircraft fire suppression bottles in the Air Force, obtained the only Halon 1301 reclamation unit in the Air Force. This unit has been operating since January of 1993. Halon 1301 is removed during hydrostatic testing and inspection of over 28,000 aircraft fire bottles that account for 240,000 lbs. of Halon 1301. The 'used' Halon, previously released to the atmosphere before hydrostatic testing, is now recovered and recycled to meet a recycled Halon specification with virtually no releases to the atmosphere. In addition to Halon, conventional refrigerant use has dropped dramatically by implementing a strict refrigerant management system, installing high efficiency purge units on all low-pressure chillers, and recycling. A 97% reduction in ODS use has been achieved by converting to non-ODS solvents and aqueous-based degreasing units.

Overall, ODS purchases were reduced 85% by the end of 1995 from a 1992 baseline of 40 tons. This has resulted in Kelly AFB being recognized as one of AFMC's two 'showcase' bases for demonstrating great progress in eliminating these chemicals.

C. EPA 17 Reduction Program - The first base specific EPA 17 Chemical Reduction Policy in the Air Force was developed and implemented by Kelly AFB on March 2, 1993. The Kelly AFB policy actively targeted reduction in the use of: 1) benzene

(excluding jet fuel); 2) cadmium; 3) carbon tetrachloride; 4) chloroform; 5) chromium; 6) cyanide; 7) lead; 8) mercury; 9) methylene chloride; 10) methyl ethyl ketone (MEK); 11) methyl isobutyl ketone; 12) nickel; 13) perchloroethylene; 14) toluene; 15) trichloroethane; 16) trichloroethylene; and 17) xylene. Examination of the 1992 baseline of 440 tons of EPA 17 chemicals; showed that 94% of Kelly's EPA 17 chemical use came from five of the 17 chemicals. Minimization projects focused on the top five EPA 17 chemicals, not only because these chemicals made up 94% of the usage, but also because the projects showed good economic justifications for elimination and/or substitution. Some of the greatest reductions were in the usage of methylene chloride, 173,410 lbs.; perchloroethylene, 83,713 lbs.; and methyl ethyl ketone, 23,273 lbs. Methylene chloride use was reduced by 87% primarily by converting to plastic media bead (PMB) blasting for paint removal. Perchloroethylene was reduced by converting to aqueous cleaners where possible, and installing new low emission vapor degreasers where the use of the chemical could not yet be eliminated. The base's goal to achieve a 50% reduction in EPA 17 chemical use by 1996 was actually surpassed (59%) two years ahead of schedule.

D. Material Substitution Program at Kelly AFB -

One of the primary objectives of the material substitution program at Kelly AFB was to eliminate the use of ODSs and EPA-17 chemicals by initiating procedural and process changes to technical orders (TOs), military specifications (MILSPECs), and military standards (MILSTDs). The P2 Team at Kelly acquired over \$2 million to fund projects designed to eliminate the use of ODSs and EPA 17 chemicals from TOs, MILSPECs, and MILSTDs. Of the 43,000 TOs maintained by SA-ALC, over 1800 were eventually identified as requiring the use of ODSs and other chemicals/materials targeted by the EPA for reduction. Process changes were initiated to eliminate 20,000 HAZMAT chemical references from these TOs, including all ODS requirements (except those for liquid oxygen).

Once a TO was selected for chemical and/or process substitution, both ODS and EPA-17 chemicals were identified. Identification of chemical and process substitutions began with reviewing and verifying the Chemical Process List (CPL) produced by the Technical Order Review Program (TORP), and identifying performance requirements for each targeted chemical on the CPL. Each alternative was compared to similar applications and processes used in previously processed TOs. In many instances, substitute alternatives were drawn from a list of "ap-

proved" alternatives which had been cleared by Kelly's Materials Engineering Branch. In other instances, research was performed to identify suitable substitutes.

Upon finalization of the process with a new Chemical Process List, the exact application of the chemical was targeted and a Form 252 (TO Change Request Form) was generated with the recommended chemical deletion and recommended alternative. For chemicals with no substitute, a listing was generated showing a "no substitute available" recommendation without performing additional testing. The Form 252 flowed into the existing TO change system, which eliminated confusion when making a large number of changes.

E. Hazardous Waste Management - The Hazardous Waste Reduction Program has been in full effect at Kelly AFB for many years. The construction of a new industrial wastewater treatment plant in 1987, along with a new sludge treatment process, were key initiatives that allowed the base to exceed the 1992 50% reduction goal for hazardous waste generation using a 1987 baseline. Other hazardous waste reduction efforts focused on segregating the hazardous and non-hazardous sludge at the treatment plant and using the non-hazardous portion of the sludge in composting operations. A second successful reduction of hazardous waste was the implementation of the Plastic Media Leasing Contract set up by the Pollution Prevention Division. This program provided a creative solution for elimination of approximately 400,000 lbs. per year of potential hazardous spent blasting media. Another successful method of reducing hazardous waste was the installation of a VOC incinerator that uses spent calibration fluid as a supplemental fuel. Kelly AFB succeeded in reducing hazardous waste disposal by 70% at the end of 1996, compared to a 1992 baseline of 1633 tons, three years ahead of schedule and 20% over the original 50% goal.

F. Solid Waste Management - In 1993, Kelly AFB implemented a Household Hazardous Waste (HHW) Collection Program for the military family housing and dormitory areas. The initial collections rounded-up 430 pounds of HHW from 701 on-base residences. The waste was properly disposed of in a licensed hazardous waste landfill with the disposal cost being absorbed by Kelly AFB.

In an effort to increase recycling activities, the "Kelly AFB Landfill Avoidance Program" was instituted to educate base personnel on recycling, reuse, and reduction practices. Kelly AFB Solid Waste Manage-

ment Meetings encouraged all base personnel to reuse packaging, pallets, and containers. Recycling of aerosol cans, paper, plastics, cardboard, newspaper, aluminum cans, tin cans, toner cartridges, glass, tires, lead acid batteries, motor oil and metals entered full force. Equipment was purchased to extend the recycling program to all base organizations and to maximize sorting of materials at the source of generation. In addition, base personnel were encouraged to buy products that contain recycled materials. Trash dumpsters destined for the landfill were monitored for improper disposition of chemicals and recyclable materials. Using a 1992 baseline of 13,528 tons, a 50 percent reduction goal was met two years ahead of schedule.

Powder Paint Coating Facility

Conventional paint coating processes for aircraft and AGE (Aerospace Ground Equipment) typically require mixing of the paint, masking, priming, curing, topcoating, paint gun cleaning, and paint disposal. Painters are required to wear approved Occupational Safety and Health Administration (OSHA) full-face respirators and protective clothing during the priming and painting operations. Prior to the installation and operation of the new powder paint coating facility in September 1997, the San Antonio Air Logistics Center/LDPB paint shop had been emitting approximately 9,000 lbs. of VOCs a year and generating 4,500 lbs. of solid waste.

The powder paint coating study was conducted to compare performance of the various powder paint coatings and the conventional liquid paint coatings under the direction of SA-ALC/TIES. The laboratory tests proved the following:

- powder paint coating is more durable and offers up to 30% better corrosion protection to the part;
- powder paint coating improves the maintainability and overall reliability of parts due to higher quality coating performance;
- powder paint coating requires less "down time" to maintain a corrosion-free item, thereby saving operation and support costs; and
- powder paint coatings are classified a non-hazardous nuisance dust, thereby eliminating the problems and cost associated with disposal of finishing process hazardous wastes, and no air permit is required.



The positively charged powder paint is applied to a grounded part prior to oven-curing.

Production engineers at Kelly AFB led the effort to design and install the first DoD production-capable automatic batch powder paint coating facility.

How Powder Paint Coating Works:

The entire powder paint coating process takes only 1 hour and effectively eliminates VOCs, spray gun clean-up, and hazardous waste generation. The powder paint coating process involves passing the parts, via an overhead conveyor system, through an aqueous soap spray (to clean any finger oils) and drying oven. The part is then masked, if necessary, transported to the paint booth, coated (as shown above), and then cured in an oven for about 20 minutes. In contrast, conventional painting processes involve masking, chromate priming, drying, 2-3 topcoats, final drying time of 12-14 hours, cleanup of the paint guns, and waste disposal of any unused paint. Powder paint coatings adhere to the part by using a spray gun that confers a positive electrostatic charge to the powder paint, which is applied to a negatively-charged (grounded) part.

The powder paint coating process yields reductions in labor costs, raw material costs, and hazardous waste disposal costs. In addition to providing substantial cost savings, the powder-paint coating results in a smoother finish than conventional coating operations. More parts can be coated more quickly, and with less surface imperfections, because the powder paint coating does not run or drip. If a powder paint-coated part becomes damaged in the field, conventional paints can be used for touch-up.

For more information on this system, contact Mr. Duane Howard, SA-ALC/LDPBE, Kelly AFB, TX 78241-5000, DSN 945-9153 or (210) 925-9153.



A view of the new chrome plating line shows the ventilation hoods that automatically wash chrome containing mist back into the tanks.

Chrome Plating Line Renovation

Chrome plating is an important process in the repair of engine, accessory, and aircraft parts at SA-ALC. The plating facility at Kelly AFB was originally designed and constructed in 1978 to support aircraft landing gear repair activities; however, before the building was occupied, the workload was changed to activities in support of engine repair. The original plating line consisted of twelve 2800-gallon chrome-plating tanks featuring push-pull ventilation systems ducted to packed bed scrubbers. The change in workload configuration allowed these tanks to be significantly downsized to 16 tanks of 700 gallons each. An environmental management contract to test air emissions for compliance with National Emissions Standards for Hazardous Air Pollutants (NESHAP) requirements for hard chrome plating revealed that SA-ALC would not meet the upcoming regulation. This was the driver for a \$2.3 million renovation of the plating line from the basement to the ceiling.

The new chrome plating system, designed by Pacific Environmental Services, Inc. of California, reduces air emissions to well below those allowed under EPA's NESHAP requirements. The new design and control technologies include an increased freeboard in the tanks, allowing the push-pull ventilation to operate more effectively and safely, and a dual system of mesh pads in the ventilation hoods that automatically wash chrome mist back into the tanks. According to the ventilation contractor, 99+% of chrome mist is captured at this point. Any fugitive emissions are ducted to high efficiency particulate air (HEPA) filters located on the roof. Gauges for recording daily pressure drop readings for the mesh pads and HEPA filters are conveniently located. Another new feature is an in-tank filtration system to

keep solutions clear of debris from the parts being plated. Another improvement added to the design included locating electrical current control devices in the center aisle between the process lines to protect them from contamination with chrome solution, while keeping them convenient for operator access. The new chrome plating system includes both tank level and temperature alarms. A drag-out rinse tank follows the chrome plating tanks. This heavy chrome rinse water is used for plating tank replenishment; thus reducing generation of chrome contaminated rinse water.

Air source testing was performed in August 1998. Results are still pending, however, based on projections by the ventilation contractor, SA-ALC is expected to easily meet the air emissions requirements. In the event that more stringent regulations are imposed in the future, the emissions would still be in compliance. A chemist in the SA-ALC Chemical Processes Laboratory, Patrick Swaggerty, (210) 925-3190, was closely involved with all aspects of the chrome plating system renovation and is the technical point of contact for this project and any other chrome plating questions at SA-ALC.

Innovative Water Conservation and Reuse Strategies

For many years, Kelly AFB progressively implemented water conservation practices and projects aimed at reducing its use of groundwater from the Edwards Aquifer. These efforts have included aggressive drought management planning, installing water conserving plumbing fixtures, re-engineering water intensive industrial processes, and the installation of water reuse irrigation systems for the Kelly AFB Golf Course. Through these efforts, Kelly AFB saved approximately 4 billion gallons of water and has cut its potable water consumption by 36% since 1984.

A. Water Supply and Use - Kelly AFB produced water for domestic, industrial, cooling, and irrigation uses from six on-base wells screened in the Edwards Aquifer. Total production capacity of the well field was 11.5 million gallons per day (gpd). Average daily consumption was approximately 3 million gpd; however, peak daily production reached 5.8 million gallons. Seasonal use varied from approximately 3.5 million gpd during July, August and September to 2.5 million gpd in November, December, January and February. The greatest demand for water at Kelly AFB was for industrial processes. Of the total on-base water consumption, 45% was used to support industrial activities. Domestic uses accounted for

35% of water consumption, while cooling tower and irrigation demands varied seasonally from 0% to 15% each. Industrial wastewater was collected and treated at Kelly AFB's Environmental Process Control Facility (EPCF). Approximately 1.2 million gallons per day were processed at the EPCF and discharged to a small receiving stream. Kelly AFB discharged over 1 million gpd of sanitary wastewater to a local POTW for treatment.

B. Water Conservation and Reuse - Kelly AFB developed and implemented an effective Water Conservation and Drought Management Plan, which outlined objectives and procedures for conserving water and responding to drought crises. Water conservation and drought management practices were supported and reinforced by public outreach and educational programs. Multi-media approaches included activities such as publishing newspaper articles, distributing brochures and educational materials, electronic bulletin board displays, broadcasts through the base e-mail system, and establishing a telephone hotline for reporting water leaks. The Water Conservation and Drought Management Plan prohibited water wasting and mandated the installation of water saving plumbing fixtures in new construction and repair/renovation projects. The plan also encouraged planting of water conserving landscapes, implementation of water saving irrigation practices, and efficient operation of the water delivery system through leak detection and repair.

Since the San Antonio, TX area is subject to periodic droughts that stress the region's water resources, Kelly AFB's Water Conservation and Drought Management Plan defined specific and rapid-responding demand reduction measures for implementation during drought crises. Four stages of the Water Conservation and Drought Management Plan were linked directly to groundwater levels measured in the Edwards Aquifer. As a preventative measure, the initial stages were implemented well in

advance of reaching critical levels in the aquifer. During the initial stages, demand reduction in discretionary uses, such as landscape and turf irrigation, were targeted. If drought conditions persisted and aquifer levels continued to drop, water use reduction efforts were escalated. In the most severe drought conditions, only water uses for health, safety, and military readiness purposes were permitted and non-essential facilities were closed.

Kelly AFB's success in developing and implementing water conservation and reuse projects was a result of an integrated team effort between the Directorate of Environmental Management, the Civil Engineering Group, the Kelly AFB Aircraft Maintenance Divisions, and the Texas Natural Resource Conservation Commission (TNRCC). Effective team coordination and planning enabled Kelly AFB to achieve reductions in water consumption while simultaneously implementing state-of-the-art technologies geared toward reducing waste generation and air emissions.

In the spring of 1992, Kelly AFB completed a landmark water reuse project. This project was designed to reuse treated industrial wastewater from the Environmental Process Control Facility (EPCF) by applying it as irrigation water on the base golf course. Kelly AFB staff, working in coordination with State officials, developed specific performance standards for the land application of treated industrial wastewater. Through this cooperative effort, which included close monitoring of irrigation practices, Kelly AFB was permitted to use up to 400,000 gpd of treated industrial wastewater for golf course irrigation. Treating and reusing wastewater generated at Kelly AFB for golf course irrigation reduced the demand on the Edwards Aquifer throughout the year, including during the summer months when aquifer demand is highest.

The above summary was adapted from an article written by William P. Ryan, SA-ALC/EMC and Robert J. Backlund, P.E., HQ AETC/CEVP.

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